UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/582,330	06/09/2006	Hitoshi Sumiya	070456-0115	4934

20277 7590 11/25/2009
MCDERMOTT WILL & EMERY LLP
600 13TH STREET, N.W.
WASHINGTON, DC 20005-3096

EXAMINER	
HAN, SHENG	
ART UNIT	**PAPER NUMBER**
1793	

MAIL DATE	DELIVERY MODE
11/25/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/582,330	SUMIYA, HITOSHI	
	Examiner	**Art Unit**	
	SHENG HAN	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 September 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5,12 and 14-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5, 12 and 14-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 09/09/09 has been entered.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

   1. Determining the scope and contents of the prior art.
   2. Ascertaining the differences between the prior art and the claims at issue.
   3. Resolving the level of ordinary skill in the pertinent art.
   4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein

were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 2, 3, 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Starchenko (WO 03/086971) and further in view of Swain (2005/0110024).

As to Claims 1 and 12, Starchenko teaches the synthesis of a superhard diamond material using boron (preferred process and abstract), for use in tools. Starchenko explains that although diamond particles and hexagonal boron nitride can be used to create the diamond particles, it is taught by the reference that the material could alternatively be graphite or a mixture of graphite and hexagonal boron nitride (abstract). The combination is then treated under high temperature of at least 700 degrees C (abstract). Further it is taught that the graphite can be subjected to a high pressure as well as temperature. The reference does not, however, specify how much boron is used. It is unclear if the boron is within the lattice however. Also, Starchenko does not specifically teach that the diamond is conductive, however, diamonds are inherently conductive.

Swain teaches a boron-doped nanocrystalline diamond (title, abstract). The diamond particles are disclosed to be between 10-16nm in size and the boron concentration is between 1 to 20ppm (para. 0034 and 0071). The elemental boron is in

the crystal as a dopant (para. 0011, 0012). This boron is incorporated within the lattice of diamond lattice (para. 0071). The diamond nanocrystals are highly conductive (para. 0031(i)). Although Swain does not specifically teach that the average particle size is below 50nm, however, it is inherent that since the particle range is all below 50nm, that the average particle size would be below 50nm. Moreover, it would have been obvious to one of ordinary skill in the art at the time of the invention to put from 1-100 ppm of boron in the diamond composition, as taught by Swain, with the diamond particles for use in tools, as taught by Starchenko because boron enables diamonds to be electrically conductive, which would make it more effective in certain tools.

Regarding Claim 2, Swain teaches an electrical resistance of 0.2 ohm cm (para. 0031). This is less than 10 ohm cm.

Regarding Claim 3, since Swain teaches a particle range of between 10-16nm (para. 0034), the maximum particle range is less than 50nm and the average particle diameter is less than 30nm.

Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Starchenko (WO 03/086971) in view of Swain (2005/0110024) as applied to Claim 1, and further in view of Akaishi (WO2004/046062). Please see the corresponding US version (2006/0115408).

Starchenko and Swain teach diamonds with a specific particle range, boron composition and resistance, but neither of them teach a hardness level of over 80-110 GPa.

Akaishi teaches a high hardness diamond having a maximum size of 100nm or less (abstract). The diamond is conductive and therefore has a low resistivity (para. 0051). Regarding the hardness, Akaishi teaches that the hardness is over 80 GPa (para. 0048, 100 GPa) and over 110 GPa (para. 0050, 115 GPa).

It would have been obvious to one of ordinary skill in the art at the time of the invention to provide the superhard diamond with a hardness of over 80 and 110 GPa, as taught by Akaishi, for use in tools, such as drills because these tools require a high strength and resistance under a lot of pressure.

Claims 12, 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Meidensha (2001/21521) and further in view of Swain (2005/0110024) and further in view of Starchenko (WO 03/086971).

Meidensha teaches a diamond with particle diameter of 1-10 micrometers (1,000-10,000 nm) (para. 0016) with a boron amount of 10,000ppm (para. 0025). The diamond is highly conductive (para. 0011). Meidensha does not specifically teach that the diamond particle is created by directly converting a graphite type carbon material with boron into diamond under a high temperature, high pressure environment such that the boron is included into the lattice of the diamond particle. Although Meidenshia forms

the diamond composition with boron, it is unclear if it is embedded within the lattice of the diamond structure.

Starchenko teaches the synthesis of a superhard diamond material using boron (preferred process and abstract), for use in tools. This can be done to make a given particle size by preparing a charge of materials with a nonhard crystal phase, adding a crystal forming additive, compacting the mixture, exposing it to temperature and pressure (abstract). The diamond particles can be made with ultrafine diamond particles of –40nm or smaller and are charged with boron. Alternatively, although diamond particles and hexagonal boron nitride can be used to create the diamond particles, it is taught by the reference that the material could alternatively be graphite or a mixture of graphite and hexagonal boron nitride (abstract). The combination is then treated under high the temperature of at least 700 degrees C (abstract). Further it is taught that the graphite can be subjected to a high pressure as well as temperature.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use graphite and a boron source instead of diamond particles that are doped with boron, as taught by Starchenko, to form the product taught by Meidensha because larger particles can be formed by use of additional material, heat and pressure.

As to the boron being embedded within the lattice, Meidensha teaches that boron is doped in the diamond crystals (para. 0011), but does not specify that doped boron indicates it is imbedded within the lattice of the diamond crystal.

Swain teaches a boron-doped nanocrystalline diamond (title, abstract). The diamond particles are disclosed to be between 10-16nm in size and the boron

concentration is between 1 to 20ppm (para. 0034 and 0071). The elemental boron is in the crystal as a dopant (para. 0011, 0012). Swain explains that this dopant boron is incorporated within the lattice of diamond lattice (para. 0071). The diamond nanocrystals are highly conductive (para. 0031(i)).

It would have been obvious to one of ordinary skill in the art at the time of the invention that since the boron functions as a dopant in the diamond particle, as taught by Meidensha, that it would be incorporated within the diamond lattice, as taught by Swain because the boron is used to form the diamond particles from graphite and since carbon bonds are more stable than boron-carbon bonds, and since the boron is intermixed with the carbon-based graphite, the boron would normally become interspersed around the diamond lattice due to the high temperature and high pressure conditions of the process of Starchenko.

Regarding Claim 13, Meidensha and Starchenko teach a diamond particle with a diameter of 1-20 microns and a boron amount of 100,000ppm, where the diamond can be formed by elemental graphite and boron, but does not teaches a particle size of less than 1,000nm.

Swain teaches a boron-doped nanocrystalline diamond (title, abstract). Swain further teaches that the resistance is 0.2 Ohm cm (para. 0031). Boron enhances conductivity which there by decreases resistance. Therefore, although the amount of boron in the claim is more than the amount described in Swain, it would be inherent that the conductivity would be less than 0.2 ohm cm.

Regarding Claim 14, the diamond particles disclosed are between 10-16nm in size (para. 0034). Although Swain does not specifically teach that the average particle size is below 500nm, however, it is inherent that since the particle range is all below 50nm, that the average particle size would be below 500nm.

Claims 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Meidensha, Starchenko and Swain as applied to claims 12 and 13 above, and further in view of Akaishi.

Meidensha, Starchenko and Swain teach a diamond with a particle size of 10,000nm and 1,000nm with a boron composition of 100,000ppm and 1 to 20ppm (para. 0034).

Akaishi teaches a high hardness diamond having a maximum size of 100nm or less (abstract). The diamond is conductive and therefore has a low resistivity (para. 0051). Regarding the hardness, Akaishi teaches that the hardness is over 80 GPa (para. 0048, 100 GPa) and over 110 GPa (para. 0050, 115 GPa).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a diamond with a hardness of over 80 and 110 GPa, as taught by Akaishi, with the diamond composition, as taught by Meidensha, Starchenko and Swain for use in tools, such as drills because these tools require a high strength and resistance under a lot of pressure.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SHENG HAN whose telephone number is (571)270-5823. The examiner can normally be reached on Monday-Thursday, 8:00-5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Melvin Curtis Mayes can be reached on 571-272-1234. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Sheng Han
Examiner
Art Unit 1793

November 10, 2009

/Melvin Curtis Mayes/
Supervisory Patent Examiner, Art Unit 1793